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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/080,397	02/21/2002	Edward Lewis Hauck	SJO920010114US 501.405US0	8331
7590 03/11/2004			EXAMINER	
DAVID W. LYNCH CRAWFORD MAUNU PLLC 1270 NORTHLAND DRIVE, SUITE 390 MENDOTA HEIGHTS, MN 55120			BRAGDON, REGINALD GLENWOOD	
			ART UNIT	PAPER NUMBER
			2188	

DATE MAILED: 03/11/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

Application No.

10/080,397

Applicant(s)

HAUCK ET AL.

Examiner

Reginald G. Bragdon

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 February 2004.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Drawings

1. The drawings were received on 20 February 2004. These drawings are approved by the Examiner.

Claim Objections

2. Claims 5 and 9 are objected to because of the following informalities:

As per claim 5, line 2, "the first controller's write back queue" should be --a write back queue of the first controller--.

As per claim 9, line 3, with data in cache meta data associated with the mirror cache line" should be --of cache meta data associated with data in the mirror cache line-- (see amended claim 23).

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

--or--

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this

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subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-3, 12-17, and 26-30 are rejected under 35 U.S.C. 102(b) as being anticipated by DeKoning et al. (5,588,110).

As per claims 1, 15, and 29-30, DeKoning et al. teaches a system and method of mirroring data between two cache memories. With reference to figure 1, there is shown two controller 18,20. Controller 18 includes a cache memory partitioned into two separate areas, primary area 34 and alternate area 36 (see column 3, line 65 to column 4, line 1). Controller 20 includes a cache memory partitioned into two separate areas, primary area 40 and alternate area 42 (see column 4, lines 1-6). The controllers can operate in a dual active mode, where each controller has a portion of its cache memory allocated for exclusive use by the other controller, where the alternate cache memory area is used in mirroring a write request stored in the primary area of the other controller (see column 4, lines 17-30).

When a first controller 18 receives a write request from a host, the data either overwrites previously written data or stores the data in available sectors of the primary cache memory area 34 (see column 5, lines 32-44). A recovery control block (RCB) is associated with each block that is written in the primary cache memory area (see column 5, lines 45-50). The data to be mirrored from the primary cache memory area 34 to the alternate cache memory area 42 is written to the same location in the alternate cache memory 42 as in the primary cache memory area 34, which is reflected in the information contained in the RCB ("selecting a mirror cache line..."). See column 4, lines 43-50. The data written in the primary memory area 34 is mirrored to the alternate cache memory area 42 ("mirroring the data..."). See figure 5, step 64a. Furthermore, the transfer of the RCB from the first controller to the second controller represents

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the “sending a message from the first controller to the second controller informing the second controller of cache meta data associated with data in the mirror cache line”. See figure 5, step 62a, and column 8, lines 35-39.

As per claims 2 and 16, DeKoning et al. teaches RCBs, which represent information about the entries in each cache 34,40 and therefore, when mirrored data has been established in caches 36,42, each controller has information about the other controller’s caches.

As per claims 3 and 17, DeKoning et al. teaches that the meta data stored in each RCB includes a virtual disk number (“logical unit number”), a logical block address, a 4-byte dirty map, and a flag word field which describes cache usage (“cache identifier...”). See column 6, lines 1-25.

As per claims 12 and 26, DeKoning et al. teaches, with reference to figure 6, a process by which data is invalidated in an RCB 45 associated with an alternate controller 20 after the primary controller writes dirty data to disk (“flushing”; see column 8, lines 64-67). The primary controller RCB state machine sets the DM bits in the RCB 44 to zero. Inherently the primary controller must send a message to the alternate controller RCB state machine 60 in order for the RCB state machine 60 to invalidate the MM bits in RCB 45 (see step 70a and column 9, lines 4-6).

As per claims 13-14 and 27-28, DeKoning et al. teaches that as a result of writing the dirty data back to storage the MM bits in the associated RCB 45 of the alternate controller are invalidated or set to zero. By invalidating or setting the MM bits to zero, the controller is informed that the data is consistent with the storage and won’t need to be written back to disk

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during a failover (claims 13 and 27) and that the location in the caches are available for reuse (claims 14 and 28). See column 9, lines 1-6.

5. Claims 1-6, 15-20, and 29-30 are rejected under 35 U.S.C. 102(e) as being anticipated by Skazinski et al. (6,574,709).

As per claims 1, 15, and 29-30, Skazinski et al. teaches a system, method, and computer program product (see the abstract) which includes first and second controllers, where each controller has a user cache 110-n, a mirror cache 115-n, and data 20-n. See figure 4. Skazinski et al. teaches that the first controller posts a mirror request to the second controller which includes an address where the semiconductor memory in the second controller should store the data. The process of determining the address in the second controller represents the claim limitation of “selecting a mirror cache line in a second controller to copy data into” while the act of posting the address to the second controller represents “sending a message from the first controller to the second controller informing the second controller of cache meta data associated with data in the mirror cache line”. See claim 2 in column 28, lines 5-9. The request also includes the data to be stored (“mirroring the data from a cache line in the first controller to the mirror cache line in the second controller”). See claim 1 in column 27, lines 57-60.

It is also noted that Skazinski et al. teaches in figure 9, step 440, selecting an alternate cache line in the second controller cache (“selecting a mirror cache line...”). See column 22, lines 17-19.

Skazinski et al. teaches transferring further data between the first and second controller, such as header information (see column 22, line 63, to column 23, line 5). This other data can also be considered meta data that is transferred between the first and second controller. Also

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transferred between the two controllers is a mirror cache line descriptor or CLD (see column 6, lines 56-59), which includes metadata information such as block information, valid blocks, and dirty blocks, and a change map (see section 5.3.5, in particular column 11, lines 8-42).

As per claims 2 and 16, Skazinski et al. teaches storing information about the second controller's cache on the first controller and visa versa. For example, Skazinski et al. teaches mirror entry memory block information and mirror cache line descriptors, which contain information about data structures that were mirrored to this controller (i.e. contents of the other controller's cache memory) by the alternate controller. See column 6, lines 45-65.

As per claims 3 and 17, Skazinski et al. teaches metadata such as block information which indicates a system drive ("logical unit number"; see column 8, line 63, to column 9, line 2 and column 11, line 9) and a sector ("logical block number"; see column 8, lines 54-62 and column 11, line 9), a dirty bit map (see column 11, lines 23-34), and valid blocks which identify which data blocks in the cache line hold valid data ("cache identifier", see column 11, lines 13-22).

As per claims 4 and 18, Skazinski et al. teaches adding a cache line [address] to a hash table during a failover process. See column 25, lines 13-14.

As per claims 5 and 19, Skazinski et al. teaches adding a cache line [address] to a write back queue during a failover process. See column 25, lines 14-17.

As per claims 6 and 20, Skazinski et al. teaches a free list of mirror locations in each controller and used by the controllers during the mirroring process for allocating of cache lines. See column 11, lines 59-67, and column 12, lines 22-29 and 46-55.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 7-11 and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over DeKoning et al. in view of Skazinski et al. (6,247,099).

As per claims 7, 10, 21, and 24, DeKoning et al. does not teach ownership of cache lines between the controllers of the dual-active controller system. Skazinski et al. teaches a dual-active controller system that includes a reservation system for maintaining ownership status of data in the system. See column 8, lines 1-7. In particular Skazinski et al. teaches using commands (either explicit or implicit) to request a reservation to a full or partial portion of a storage volume (“requesting ownership of a cache line”; claims 7 and 21; see column 8, lines 14-22) and granting the reservation request (“switching ownership of cache lines...”; claims 10 and 24; see column 8, lines 44-49). It would have been obvious to one of ordinary skill in the art to have modified DeKoning et al. to implement a ownership request and grant system between the active controllers, as suggested by Skazinski et al. because Skazinski et al. teaches that such an implementation would maintain cache coherency between the plurality of controllers (see column 4, lines 39-41).

As per claims 8-9 and 22-23, after a first controller has been granted ownership rights, as detailed above for claims 7 and 21, the first controller may then mirror new data and an RCB (“meta data”) as detailed above for claims 1 and 15.

As per claims 11 and 25, the combination of DeKoning et al. and Skazinski et al. does not teach transferring cache lines owned by a survivor controller to a replacement controller during failover. However, it would have been obvious to one of ordinary skill in the art to have transferred lines from a survivor controller to a replacement controller because this would ensure redundancy and consistency in the system when the replacement controller was brought online.

Response to Arguments

8. Applicant's arguments filed 20 February 2004 have been fully considered but they are not persuasive.

Applicant argues that DeKoning et al. does not teach, disclose or suggest "sending a message from the first controller to the second controller informing the second controller of cache meta data associated with data in the mirror cache line". Applicant further argues that since the RCBs are sent to alternate controllers before mirroring data, information associated with the data in the mirror cache line is not yet available. It is not clear how this is relevant since the claims do not set forth a particular order of operation. The cache meta data can be sent to the second controller prior to mirroring the data from the first controller to the second controller. Furthermore, the RCBs taught by DeKoning et al. are clearly "cache meta data associated with data in the mirror cache line". See column 5, lines 45-64; column 6, lines 1-56, and figure 2.

With respect to Applicant's arguments concerning the Skazinski et al. ('709) reference, these are not persuasive. Applicant merely argues that the header information of Skazinski et al. ('709) does not teach "mirroring the data..." and "sending a message..." without actually addressing the aspects of the rejection that are set forth as teaching the invention (e.g. column 28,

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lines 5-9, and column 27, lines 57-60). It also appears that the section cited by Applicant (column 22, lines 61-66) supports the Examiner's statement that Skazinski et al. teaches sending a message containing cache meta data.

With respect to the arguments concerning the Skazinski et al. ('099) reference, it is noted that the reference is only used in a 35 U.S.C. 103 rejection with DeKoning et al. Applicant has not addressed the combination of references. The Examiner maintains that the combination of references teaches the claimed invention as set in the rejection under 35 U.S.C. 103.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any response to this final action should be mailed to:

Box AF

Commissioner of Patents and Trademarks
Washington, D.C. 20231

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All "OFFICIAL" patent application related correspondence transmitted by FAX must be directed to the central FAX number at (703) 872-9306:

"INFORMAL" or "DRAFT" FAX communications may be sent to the Examiner at (703) 746-5693, only after approval by the Examiner.

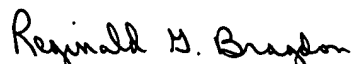
Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA., Fourth Floor (receptionist).

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Reginald G. Bragdon whose telephone number is (703) 305-3823. The examiner can normally be reached on Monday-Thursday from 7:00 AM to 4:30 PM and every other Friday from 7:00 AM to 3:30 PM.

The examiner's supervisor, Mano Padmanabhan, can be reached at (703) 306-2903.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3900.

RGB
March 10, 2004


Reginald G. Bragdon
Primary Patent Examiner
Art Unit 2188